

Dynamic EV Wireless Charging

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Abstract—Electric vehicles (EVs) are becoming one of the most important solutions for reducing environmental pollution and dependence on fossil fuels. However, conventional wired charging systems suffer from drawbacks such as long charging duration, range anxiety, and limited charging infrastructure. Dynamic Wireless Charging (DWC) technology has emerged as a promising solution to overcome these limitations. This paper presents a Dynamic Wireless Charging System for Electric Vehicles using Wireless Power Transfer (WPT) based on electromagnetic induction. The proposed system enables electric vehicles to charge while moving by transferring power wirelessly from transmitter coils embedded beneath the road surface to receiver coils mounted under the vehicle. The paper discusses the working principle, methodology, advantages, challenges, and future scope of the proposed system.

Index Terms—Electric Vehicles, Wireless Power Transfer, Dynamic Wireless Charging, Electromagnetic Induction, Inductive Power Transfer.

I. INTRODUCTION

The increasing demand for sustainable transportation and growing environmental concerns have accelerated the development of electric vehicles. EVs provide a cleaner alternative to conventional vehicles by reducing harmful emissions and fuel consumption. Despite these advantages, the adoption of electric vehicles is still limited due to charging related challenges. Traditional charging systems require EVs to stop at charging stations for extended periods. This creates inconvenience for users and limits long-distance travel. Dynamic Wireless Charging technology enables vehicles to charge while moving, thereby reducing charging downtime and range anxiety. Wireless charging systems use electromagnetic induction to transfer energy between transmitter and

receiver coils. The transmitter coil is embedded beneath the road while the receiver coil is mounted underneath the electric vehicle.

II. LITERATURE REVIEW

Parallel Transmission of Power and Signal Based on The Combination of Inductance and Capacitance for EV Dynamic Wireless Charging System (2022) Authors: Fan Zheng, Xiaofei Li, Yilin Tan, Chunsen Tang, Zhihui Wang.

[1] This paper proposed a method for simultaneous wireless transmission of power and communication signals in dynamic EV charging systems. The system uses magnetic fields for power transfer and parasitic capacitance based electric fields for signal transmission. The proposed method reduces system complexity, improves efficiency, and enables real-time communication between transmitter and receiver units during charging.

A Review of Dynamic Wireless EV Charging (2025) Authors: Eleena Sara Thomas, Gokul Siva G S, Rehamiya Sheik U, Surya Ananthasivan, Shaija P J, Alex Jose. [2] This review paper discussed various wireless power transfer techniques, converter topologies, compensation methods, and coil structures used in EV charging systems. It emphasized Resonance Inductive Power Transfer (RIPT) for dynamic charging applications and highlighted the importance of coil alignment, coupling coefficient, and resonant frequency for achieving efficient wireless charging.

Dynamic Wireless Charging System for Electric Vehicles (2024) Authors: Deepak V. Prasad, Vishal S. Lande, Abhishek P. Bornare, Payal B. Waghmare, Dr. M. Sujith. [3] This paper introduced a Dynamic Wireless Charging System (DWCS) that enables electric vehicles to charge while moving using

wireless power transfer technology. The system integrates charging infrastructure into roadways and utilizes inductive coupling for efficient energy transfer. The research focused on reducing range anxiety, improving charging accessibility, and increasing EV adoption.

Dynamic Wireless Electric Vehicle Charging System with Integration of Square Coils and Solar Energy (2024) Authors: Mrs. Chithra V, Dr. Priya C, Karthik S L, M Barath Kumar, Chandravelan M P, Vijay Kumar A. [4] This work proposed a dynamic wireless EV charging system that integrates square coils and solar energy. Square coils were used to improve magnetic flux linkage, alignment tolerance, and magnetic field uniformity while reducing electromagnetic interference. The incorporation of solar panels supports renewable energy-based charging infrastructure for sustainable transportation systems.

Optimization of Dynamic Wireless Charging Efficiency Using Bypass Charging Technique (2025) Authors: Krishna Sai Charith, D Sathish Naik, B Sai Vara Prasad, C. Bhargava. [5] This paper explored the use of bypass charging techniques in Dynamic Wireless Power Transfer (DWPT) systems. The proposed method directly powers vehicle loads instead of routing all power through the battery, thereby reducing battery stress and improving system efficiency by 5–10 percent. The research also highlighted the advantages of reduced thermal issues, lower battery size requirements, and enhanced real-time power utilization.

Dynamic EV Charging by Wireless Power Transfer (2022) Authors: R. Kavin, D. Ajay, D. Arvind, K. Karpaganathan, and S. Dhanush. [6] This paper proposed a wireless power transfer system using transmitter coils embedded beneath roads and receiver coils mounted on EVs. The system utilizes solar powered charging infrastructure to improve energy efficiency and reduce dependency on conventional charging stations.

On the Coordination of Charging Demand of Electric Vehicles in a Network of Dynamic Wireless Charging Systems (2022) Authors: Eiman Elghanam, Hazem Sharf, Yazan Odeh, Mohamed S. Hassan,

and Ahmed H. Osman.

[7] This study presented an online coordination algorithm for allocating EVs to optimal dynamic wireless charging lanes. The work focused on load balancing, reduced charging downtime, and efficient energy management in smart city environments.

Wireless EV On Road Charging System (WEVOS) (2025) Authors: Dr. Deepa N. Reddy, Shashank C. Panthangi, Sourabh K. H, Spandan S. Salimath, and Suhas B. S. [8] This research developed a wireless charging system using electromagnetic induction for both stationary and moving EVs. The system emphasized reducing charging infrastructure complexity, eliminating range anxiety, and improving user convenience.

I. A 30 kW Dynamic Wireless Inductive Charging System for EVs (2022) Authors: Zariff Meira Gomes, Jose Renes Pinheiro, Gilney Damm, Karim Kadem, and Hassan Moussa. [9] This paper designed a high-efficiency 30 kW dynamic wireless charging system capable of charging vehicles while in motion. The system achieved nearly 90% efficiency using resonant inductive coupling and advanced converter control techniques.

J. Coil Design and Efficiency Analysis for Dynamic Wireless Charging System for Electric Vehicles (2016) Authors: Xian Zhang, Zhaoyang Yuan, Qingxin Yang, Yongjian Li, Jianguo Zhu, and Yang Li. [10] This paper proposed an improved coil structure called Grouped Periodic Series Spiral Coupler (GPSSC) to enhance transmission efficiency and reduce power fluctuations during dynamic charging.

K. Dynamic Wireless Charging System for EV Vehicles (2025) Authors: Surabhi Kakade, Sharvari Savardekar, Shreya Sonawane, Shivanand Satao, and Omkar Shinde. [11] This work implemented a cost-effective dynamic wireless charging prototype using Arduino UNO, sensors, and copper coils. The study focused on practical implementation, continuous power transfer, and affordable EV charging solutions.

III. CONCLUSION

In Phase I of the project, the concept and working principle of the Dynamic Wireless Charging System for Electric Vehicles were successfully studied and analyzed. The literature survey was carried out to understand various wireless power transfer techniques and recent developments in dynamic EV charging systems. Based on the study, the block diagram and methodology of the proposed system were designed using Inductive Power Transfer (IPT) technology.

The project mainly focuses on transferring electrical power wirelessly between transmitter coils embedded beneath the road and receiver coils installed underneath the vehicle through electromagnetic induction. Basic simulation outputs and system analysis were also carried out to understand the charging process and power transfer mechanism. The proposed system aims to reduce charging downtime, minimize range anxiety, and improve the overall convenience and efficiency of electric vehicle charging.

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